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**STUDY OF EXPERIMENTAL
SANDHILL CRANE HUNTING SEASON
IN NEW MEXICO
DURING JANUARY 1961**



SPECIAL SCIENTIFIC REPORT: WILDLIFE No. 63

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UNITED STATES DEPARTMENT OF THE INTERIOR
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BUREAU OF SPORT FISHERIES AND WILDLIFE

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United States Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife

STUDY OF EXPERIMENTAL SANDHILL CRANE HUNTING SEASON
IN NEW MEXICO DURING JANUARY 1961

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ABSTRACT

The first open season for hunting sandhill cranes in the United States was permitted during January 1961, in the eastern counties of New Mexico. The population of these birds in the area of hunting was 150,000 before the season opened. After one week of hunting and throughout the remainder of the season the population dropped to 1,500 birds due to moving out of the area into west Texas. An estimated 1,446 hunters participated and shot an estimated 542 cranes, or 1.7 percent of those present in the area. Weights and measurements of all cranes which passed through checking stations indicated none of the race known as greater sandhill crane had been taken. Sex ratio of checked cranes was 59 males to 60 females. Age ratio was 107 adults to 30 immatures. Food eaten consisted almost entirely of grain sorghums and green alfalfa.

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STUDY OF EXPERIMENTAL SANDHILL CRANE HUNTING SEASON IN NEW MEXICO DURING JANUARY 1961

Introduction

This report presents the results of a cooperative study of the first sandhill crane hunting season permitted since the Migratory Bird Treaty between Great Britain and the United States was ratified in 1916. Background information contained in the report was taken from various sources, chief of which were the monograph of the sandhill crane by Walkinshaw (1949) and administrative reports of the Bureau of Sport Fisheries and Wildlife. Hunting season data were accumulated by personnel of the New Mexico Department of Game and Fish and the following units of the Bureau of Sport Fisheries and Wildlife:

- (a) Denver Wildlife Research Center
- (b) Southwest Region - Albuquerque, New Mexico -
Branches of Management and Enforcement and
Wildlife Refuges
- (c) Bird and Mammal Laboratories, Washington, D.C.

In addition to the above, representatives of the National Audubon Society and the Wildlife Management Institute took part in portions of the census work, and many hunters contributed to the kill data by permitting cranes they had bagged to be weighed, measured, and otherwise studied.

History and Background

The sandhill crane is defined by the Migratory Bird Treaties as a "migratory game bird." Despite this fact, prior to 1960 no open season had been permitted on this species since the migratory bird laws went into effect. This was primarily due to the prevailing idea that the species could not stand a harvest. This attitude was based largely on the knowledge that certain of the races of this species - the Florida and greater sandhill cranes - were relatively scarce, although the lesser sandhill crane was known to be very numerous. A lack of knowledge of the migrations and winter distribution of these races led to concern that the rarer populations might be endangered by legalizing hunting in any area where these birds occurred.

Over a period of years prior to 1960 sentiment favoring an open season on sandhill cranes had increased. This resulted from recurring depredations of cranes on small grain crops, both in Canada and the United States, as well as the increasing feeling among sportsmen and game management people that certain populations of this migratory game bird could withstand harvest under proper management. This growing conviction culminated in formal requests by the Central Flyway Council and the National Waterfowl Flyway Council during each of several years prior to 1960 for a limited open season on sandhill cranes. Final decision to permit hunting of any sandhills was deferred for several years until more information could be obtained on the distribution and abundance of the various crane populations.

By 1960 the Bureau of Sport Fisheries and Wildlife and the State of New Mexico Department of Game and Fish, through their research activities, had amassed sufficient evidence to show that neither the whooping crane nor the greater sandhill crane would be endangered by a hunting season limited to certain counties of eastern New Mexico and western Texas where the greatest concentrations of the lesser sandhill crane occurred. The studies of distribution of the greater and lesser sandhill cranes were based on extensive collecting and trapping of cranes carried out by the Bureau of Sport Fisheries and Wildlife (Aldrich and Burleigh ms. 1958) and the New Mexico Department of Game and Fish (Huey ms. 1960) in New Mexico and Texas during the period 1957 to 1960. The conclusions were that very few, if any, greater sandhill cranes occur in the area proposed for hunting in the eastern counties of New Mexico and western counties of Texas. To prevent any danger to the near-extinct whooping crane, data obtained from studies of the migration of this species by Allen (1952) were used in recommending areas and dates for an open season on sandhill crane.

Meanwhile there was growing concern over sandhill crane depredations on wheat in North Dakota, discussed in reports by Smith and Boeker (ms. 1958) and Timmerman (ms. 1958) and in the province of Saskatchewan documented by Munro (1950). It became so acute in the latter area in 1959 that provincial officials, with the concurrence of the Canadian Wildlife Service, decided to allow hunters to assist farmers in protecting their crops by shooting sandhill cranes without special permit in specific areas where these birds were causing damage. Recognizing the potential danger of this procedure to whooping cranes which migrate through this section of Saskatchewan, the provincial and Canadian Wildlife Service officials in 1960 proposed an open season on lesser sandhill cranes in their major wintering areas in the United States. This plan was designed to relieve the situation in Saskatchewan, but in a way that the whooping crane would not be endangered.

As a result of the combined recommendations of the Flyway Councils, the Saskatchewan Department of Natural Resources, the Canadian Wildlife Service, and the U. S. Bureau of Sport Fisheries and Wildlife, an experimental open season was authorized by the Secretary of the Interior. Regulations for this season limited hunting to the major concentration areas of lesser sandhill cranes in western Texas and eastern New Mexico during the period January 1-30, 1961. Prior to the opening date, however, it was discovered that the authority of the Texas Game and Fish Commission to regulate hunting of migratory game birds did not include sandhill cranes. Therefore, this first sandhill crane hunting season, which specified a limit of two birds daily and two in possession, was limited to a six-county area in New Mexico.

Shortly after the open season was formally set, plans were formulated to conduct studies adequate to appraise the effects of the hunting season and to obtain all information possible on races, age and sex ratios, and food habits materials of bagged birds, as well as impact of hunting on crane populations, crippling losses, hunter success, and other facts pertinent to management of this species.

Objectives

A cooperative study was organized between the New Mexico Department of Game and Fish and the Bureau of Sport Fisheries and Wildlife, designed to gather information toward the following objectives:

1. To obtain and accumulate all possible information on the numbers of cranes in the hunting area, the dates of their arrivals and departures, and on crane depredations during the season.
2. To ascertain the racial composition of the flocks.
3. To devise techniques for sexing and aging cranes in the field.
4. To evaluate the effect of the hunting season on flock size and distribution.
5. To accumulate information on:
 - (a) Hunter success
 - (b) Crippling loss
 - (c) Hunting methods
 - (d) Palatability and sporting quality of cranes
 - (e) Landowners' and sportsmen's reaction to season
 - (f) Climatic influences on hunting
 - (g) Food habits of cranes

Procedures

All personnel assigned to the study were notified of the information required and how it was to be collected. Specific responsibilities for collecting data on each phase of the study were assigned.

Data pertaining to numbers and distribution of the crane population were obtained through coordinated biweekly ground counts at major roosting areas in eastern New Mexico and western Texas. These counts were initiated in late November 1960 and continued through February 1961.

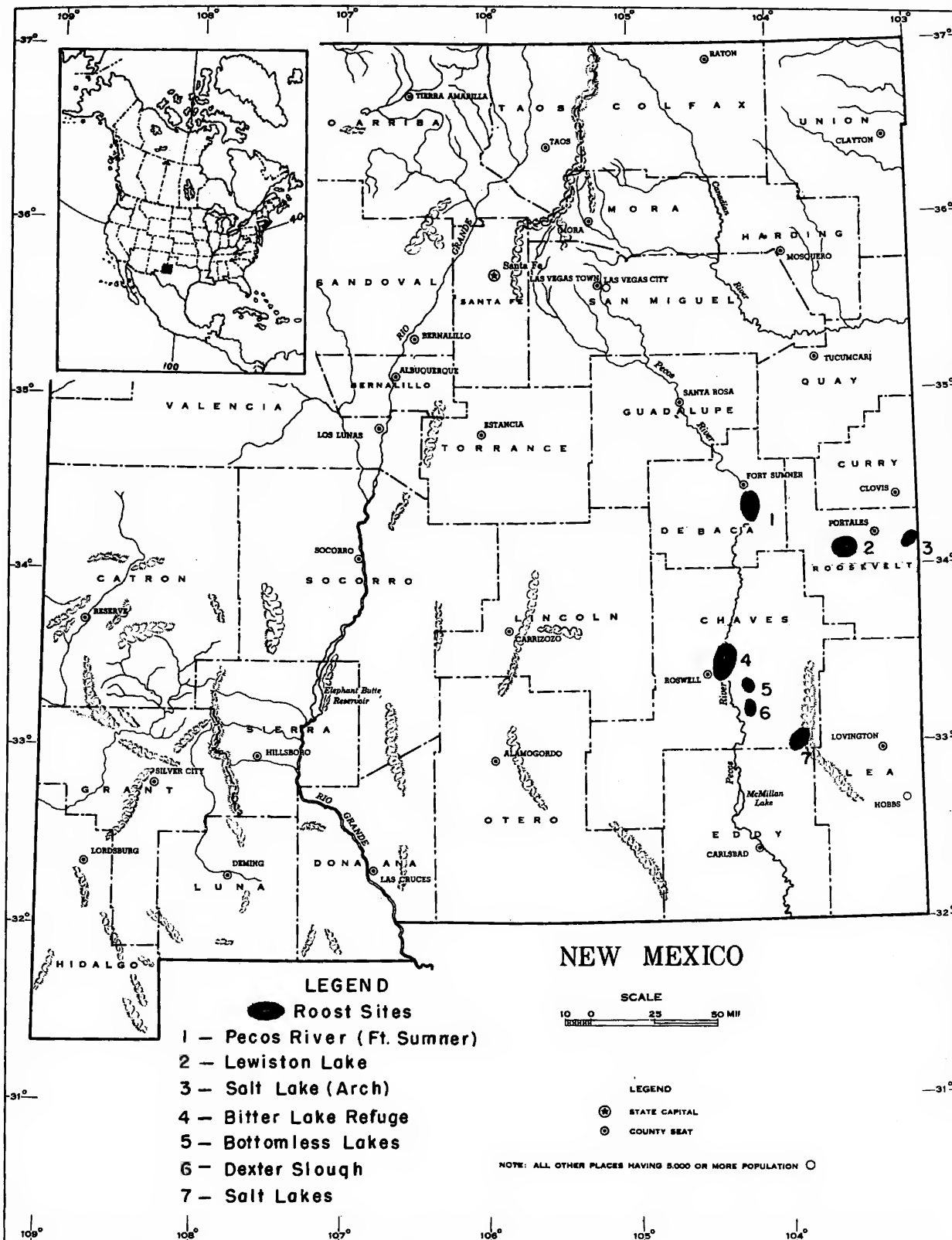
Information relating to the racial composition of the flocks and possible techniques for sexing and aging cranes in the field was accumulated by all personnel. In addition to extensive field checks by New Mexico and Bureau personnel, three checking stations located at Portales, Roswell, and Dexter, New Mexico, were operated throughout the season. Advance publicity on the season by the New Mexico Department through such media as newspapers, radio, television, and N. M. Department news releases specified the need for all information available. Hunters were asked to bring all bagged birds to the checking stations where data relating to age, sex, weight, measurements, and hunting information were recorded on special forms. Standard measurements were taken with a steel tape and weights with a spring scales. Sex was determined by dissection and examination of the sex organs. Age was determined by extent and coloration of feathers on the head. Birds of the year had feathers remaining on the crown, which in adults is bare red skin. In addition young birds had brown colored feathers on the back of the head; in adults these feathers are gray.

The effect of hunting on flock size, behavior, and distribution of cranes was measured by daily ground and aerial observations in the hunting area, observation of hunting effort, and by actual hunting experience.

Advance planning resulted in a coordinated program carried out by State and Federal personnel to collect and evaluate hunt data, with no duplication of effort.

Results

(a) Populations: The major wintering grounds of the lesser sandhill crane extend from the Pecos Valley in eastern New Mexico eastward into the high plains of northwest Texas (Figure 1). While largest concentrations of the birds are usually found on or near the Muleshoe National Wildlife Refuge, Bailey County, Texas, and the Bitter Lake National Wildlife Refuge in Chaves County, New Mexico, other sizable populations are scattered throughout the area. Winter requirements of the cranes are apparently well met in this region by an abundance of food and adequate roosting sites.



Principal food crops grown in the area include varieties of grain sorghums upon which the cranes feed extensively. Shallow alkaline lakes preferred for roosting sites are scattered throughout the region.

The census data included in Table 1 are the result of coordinated ground counts conducted at each of the major crane roosting sites on the dates shown. Note that a major population shift out of the New Mexico hunting area occurred between the December 31 and January 13 counts. Observations of January 8 indicate that at least a major portion and perhaps all of these birds moved into the west Texas area where they were safe from the harassment of hunters.

Table 1.--Sandhill Crane Counts - New Mexico and Texas (1960-61)

Area	D a t e s					
	Nov. 30- Dec. 1	Dec. 14&15	Dec. 31	Jan. 13	Jan. 30	Feb. 15-17
NEW MEXICO						
Pecos River	1,500	379	38	987	865	1,350
(Ft. Sumner)						
Lewiston Lake	11,415	14,815	14,935	48	0	53
Salt Lake (Arch)	5,452	6,722	5,900	0	0	0
Bitter Lake Refuge	8,340	2,300	4,596	350	245	600
Bottomless Lakes	4,000	2,500	1,950	0	0	0
Dexter Slough	1,100	1,135	965	0	0	0
Salt Lakes	<u>3,266</u>	<u>6,791</u>	<u>2,718</u>	<u>73</u>	<u>1,000</u>	<u>161</u>
Subtotals	35,073	34,642	31,102	1,458	2,110	2,164
TEXAS						
Rich Lake	9,500	2,300	No Breakdown	((10,300
Mound Lake	22,000	23,600		((23,000
Double Lakes	11,200	8,900		(42,100	(48,000	10,000
Cedar Lake	5,200	4,300		((7,000
Coyote Lake	22,400	18,000		20,000	26,000	12,000
Baileyboro Lake	8,500	-		16,000	27,000	5,200
(No Name) Lake	8,800	500		-	-	6,500
Muleshoe Refuge	<u>12,000</u>	<u>42,000</u>		<u>44,000</u>	<u>39,000</u>	<u>16,000</u>
Subtotals	99,600	99,600	118,600	122,100	140,000	90,000
TOTALS -						
(N.Mex. & Texas)	134,673	134,242	149,702	123,558	142,110	92,164

The optimum time for conducting counts was found to be the early morning period while the cranes are leaving their roosts in successive groups. Cranes disperse widely over a large area during the daylight hours and normally do not return to the roosts until near or after dark. The technique used in this study was for the observers to station themselves in a position near the roosts where they were able to record the number of cranes in each of the departing groups. Because the cranes habitually left their roosts in small groups, it was possible to make accurate counts on large numbers of individuals by this method.

(b) Depredations: Since the harvest had been completed and practically all shocked grain had been removed from the fields before the crane season opened very little depredation occurred at that time. Complaints received from three farmers in the Roswell area were investigated and found to involve injury to grain crops, but the loss was not heavy. The fact that most of the cranes left the hunting area after a week of shooting certainly suggests that hunting would control local damages if the season was held at the time when serious depredations occur.

Sandhill crane depredations in eastern New Mexico and western Texas have been studied over the years and have been documented in research reports by Sperry (ms. 1939), Sooter (ms. 1949), and Linduska (ms. 1958). These studies indicated the existence of a serious depredation problem which has persisted throughout the years, varying in severity from year to year with changes in farming practices and weather. Damages to sorghum grain crops have been the most widespread and serious of the depredations committed by cranes; however, there have been numerous complaints involving other types of damage. These include taking mature corn; excessive grazing on alfalfa; trampling freshly listed land, making it more susceptible to wind erosion; trampling and breaking up small irrigation ditches and lister ridges, causing the loss or misdirection of irrigation water; puddling and compacting of soil. Tabulation of complaints received from farmers was made by the manager of the Muleshoe Refuge in the 1957-58 season. These were 54 in October, 209 in November, 41 in December, and 5 in January. Estimates of loss on individual farms in this area that season were: (1) matured dry land milo, 10 percent of crop; (2) scratch in lister rows, pull young wheat and clip heads of mature wheat, 15 percent of crop; (3) grain bundles in shock, 20 percent of crop. Other examples of damage are: 40 acres of green barley at Roswell completely destroyed and 25 acres of sorghum 10 percent consumed by cranes in October, November, and December 1957; in November 1958 cranes ate all the seed from the heads of 30 acres of shocked milo on a farm southeast of Roswell; on a farm northeast of that town a farmer estimated that he lost 4,000 pounds of hegari seed to cranes in October 1958; the same farmer reported that cranes consumed 50 percent of the late crop of alfalfa on a 30-acre field.

(c) Identification of sandhill crane races: One of the most important considerations in permitting hunting of the sandhill crane has been the possible effect on the population of the relatively rare subspecies known as the greater sandhill crane. Preliminary studies of collected and banded cranes failed to disclose the presence in the eastern counties of New Mexico and western counties of Texas of a single example of the greater sandhill. Planning for the study of the experimental open season in eastern New Mexico in January 1961 included an analysis of measurements of birds passed through checking stations, as a further check on the presence of greater sandhills in that area.

Forms for recording standard measurements in inches of checked birds were prepared by the New Mexico Department of Game and Fish through consultation between William Huey of that Department and John Aldrich of the Bureau of Sport Fisheries and Wildlife. These measurements included bill (from posterior end of nostril to tip), wing, tail, tarsus, and mid-toe. On December 31, the day before the season opened, representatives of the New Mexico Department of Game and Fish and the Bureau of Sport Fisheries and Wildlife who were to participate in the joint study met in the office of the former agency in Roswell, New Mexico, for a final briefing on procedures including the methods of measuring cranes. The forms were provided with illustrations of the various measurements, and these were discussed with technicians present by Huey and Aldrich. Measurements and weights were to be taken of all birds brought to the three checking stations in New Mexico (the Bureau of Sport Fisheries and Wildlife fish hatchery at Dexter, the offices of the New Mexico Department of Game and Fish at Roswell, and the County Courthouse at Portales) and of those birds checked by workers in the field. Through advance publicity hunters were requested to bring their cranes to the checking stations.

A total of 137 cranes were weighed and measured at these checking stations. During the first few days of the season a review of the methods employed by the checkers disclosed a lack of uniformity of methods of making measurements of wing and toe. Although efforts were made at standardization, it is felt that the measurements of these two appendages were unreliable and are omitted from the analysis.

All measurement sheets were collected by the New Mexico Department of Game and Fish after the hunting season was over, and the figures were converted from inches to millimeters by that agency. A copy of the converted measurements was forwarded to Dr. Aldrich in Washington for analysis.

Measurements of museum specimens of known breeding sandhill cranes of the greater and lesser races were tabulated (Tables 2 and 3). A t test of these measurements was run by Dr. Don Hayne, biometrician, Branch of Wildlife Research, Bureau of Sport Fisheries and Wildlife, to determine the p values for each measurement by race and sex. Each measurement of bill, tail, and tarsus of the cranes checked during the New Mexico hunting season (see Appendix) was compared with the p values to determine the percentage of probability that these birds belonged to one or the other breeding population represented by the museum specimens.

Although the samples of known breeding birds were small and the spread of measurement values indicated by the statistical analysis is probably greater than would be the case with a larger number of birds, there was very little similarity between the sizes of the hunted cranes and the known breeding sample of greater sandhills. Eight adults and one immature male and one adult and one immature female bird of the sample measured in the checking station had a single measurement each which was closer in terms of percent of probability to the collection of breeding greater sandhills than to the lessers. In the other two measurements they were closer to lesser sandhills.

Table 2. --Measurements of Greater Sandhill Cranes
(Breeding Adults)

Sex	Locality	Date	Wing Chord	Tail	Culmen from posterior end of nostril	Tar- sus	Middle toe without claw
♂	N.Dak.: Rock L.	June 12, 1895	523	189	99.5	249	79.5
♂	Idaho: Henry's Lake	" 10, 1957	526	200	116	231	82
♂	" : Gray's Lake	May 26, 1951	540	208	101	243	86
♂	Calif.: Fort Crook	Apr. 20, 1860	553	205	105	264	88
♀	N.Dak.: Towner Co.	June 10, 1895	537	197	99	238	80
♀	Oreg.: Lake Co., Adel	May 30, 1925	510	185	97	237	79
♀	Mich.: Seney Refuge	Aug. 26, 1959	490	183	101	221	75
♀	" " "	" 22, 1960	520	204	103	223	79
♀	" " "	" 18, 1960	490	190	98.5	229	80.5

A few weights of cranes taken on the breeding grounds are available in Walkinshaw's (1949) monograph. Weights of 6 male greaters range from 10 lbs. 8 oz. to 13 lbs.; 3 females from 9 lbs. 4 oz. to 11 lbs. The single weight given for a true lesser sandhill from Alaska was 6 lbs. 12 oz. Weights of sandhill cranes taken for banding at Bosque del Apache Refuge, identified as greaters on combined characters, were all 10 lbs. or over. Weights of sandhills identified as lessers banded at Bitter Lake Refuge were all 8 lbs. 13 oz. or under.

The weights of all cranes checked during the hunting season are listed in Appendix. The maximum was 8 lbs. 12 oz. The average weight of 46 adult males was 7 lbs. 12 oz. and of 50 adult females, 7 lbs. 1 oz. Examination of all data leads to the conclusion that all sandhill cranes in normal flesh and weighing over 10 lbs. are greaters and all under 9 lbs. are lessers.

From cranes checked during the hunting season, the average length of the bill from posterior end of the nostril was 75.7 mm. on the adult males and 71.2 mm. on the adult females. The most significant difference

between male and female measurements existed in the tarsal length, which averaged 186.7 mm. on adult males and 174.9 mm. on adult females. The averages of comparable measurements on the immature specimens checked were only slightly lower than for the adults.

Table 3. --Measurements of Lesser Sandhill Cranes
(Breeding Adults)

Sex	Locality	Date	Wing chord	Tail	Culmen from postr. end of nostril	Tarsus	Middle toe without claw
♂	Alaska:Ft. Kenai	May 4, 1869	493	187	76	206	72
♂	" : Petersburg	June 23, 1941	462	176	69	192	68
♂	" : 80 mi. up Nushagak R.	" 28, 1881	460	162	73	188	62
♂	" : St. Michael	" 7, 1881	494	160	75	197	74
♂	" : Point Barrow	" 20, 1883	439	163	75	196	66
♂	" : St. Michael	" 3, 1880	475	162	72	210	70
♂	" : " "	Aug. 24, 1878	475	169	70	192	66
♂	" : Point Barrow	June 1, 1883	462	156	70	186	66
♂	" : Fort Cosmos	May 23, 1886	503	178	71	207	67
♂	Mackenzie: Fort Resolution	June 19, 1903	487	176	85	224	75
♂	Alaska: 25 mi. inland Kokechick R.	July 24, 1924	440	178	65	178	71
♂	Alaska:Nome	May 28, 1903	433	169	60	165	67
♂	" : " "	" " , 1907	463	171	69.5	202	70
♀	" : Nushagak R.	July 28, 1881	424	153	66	184	70
♀	" : St. Michael	June 7, 1881	430	165	66	156	64
♀	Mackenzie: Fort Resolution	June 19, 1903	456	164	73	211	64
♀	Alaska:Kokechik R.	July 24, 1924	437	164	68	166	65
♀	" : St. Michael	May 14, 1881	446	145	74	191	68
♀	" : Ft. Kenai	May 6, 1869	485	171	-	198	75
♀	" : Hooper Bay	June 10, 1924	465	177	63	174	63

Comparison of weights and measurements of sandhill cranes shot during the open season of January 1961 in the eastern counties of New Mexico with all known criteria for distinguishing the greater and lesser sandhill cranes leads to the conclusion that no greater sandhills were shot. This bears out previous studies from collected and banded cranes that birds of this species wintering in the eastern counties of New Mexico and the western counties of Texas are almost entirely, if not entirely, lesser sandhill cranes.

(d) Age and sex ratio: Of the 143 birds checked, the age, determined by head feathering, was recorded on 137. The ratio of this sample was 107 adult to 30 immature, or 78.1:21.9. This closely parallels the ratios of adult to immatures found in cranes trapped for banding before the season opened in December 1960 on the Bitter Lake National Wildlife Refuge. It is impossible to determine from these data alone whether or not any differential exists in vulnerability between adult and immature individuals.

The sex, determined by dissection, was recorded on 119 of the birds checked. The ratio was 59 males to 60 females, or 49.6:50.4.

An attempt was made with the data to devise some system whereby the weight, some measurement, or a combination of weights and measurements, could be used to determine the sex of live birds in the field. The weight alone in this group of data proved to be the most reliable. When 7 lbs. 4 oz. was used as the dividing line, about 80 percent accuracy was realized. Of the adult females checked, 82 percent weighed less than 7 lbs. 4 oz., and 78 percent of the adult males exceeded this amount. None of the measurements nor a combination of measurements contributed any refinement to this method.

(e) Food habits: An analysis of the contents from 51 crane gizzards collected during the hunting season is shown in Table 4.

By air-dried weight, almost three-fourths of the material contained in the gizzards sampled was grit (small stones and gravel). Ninety-seven percent of the remaining contents was composed of seed, seed-hulls, and stems from various species of sorghum and green alfalfa. The remaining 3 percent included feathers and dry grass materials.

(f) Landowner and sportsman reaction: Landowner reaction to the cranes and the hunting season varied in accordance with their experience. Those with crops subject to depredations, such as small grains, were against cranes and for hunting; those who grew cotton were indifferent.

On the opening days of the crane season, hunting pressure was light compared to that which is exerted on other species in this area. Hunter interest increased after methods for taking cranes were learned. However, before the season was well under way, the crane population in the hunting

Table 4.--Sandhill Crane Food Analysis
Gizzards collected in New Mexico (Pecos Valley) during January 1961

All wts. expressed in grams--food materials air-dried								
Speci- men #	Area Collected	Gizzard	(Sorghum Grains)					Total
		Wt.	Grit	Alfalfa	Milo	Cane	Misc.	
1	S.Edge Bitter Lake Ref.	95	9	-	3	-	1	13
2	" " " " "	106	11	-	4	-	-	15
3	" " " " "	94	21	-	4	-	1	26
4	" " " " "	115	18	-	-	5	-	23
5	" " " " "	103	19	3	-	-	-	22
6	" " " " "	105	15	-	4	-	1	20
7	1 Mi. S. Dexter	105	18	8	-	-	-	26
8	" " " " "	110	21	7	-	-	-	28
9	" " " " "	108	19	7	2	-	-	28
10	?	75	14	4	-	-	-	18
11	?	80	12	4	-	-	-	16
12	9 Mi. W. Roswell	150	20	-	16	-	-	36
13	Salt Lakes	128	30	-	-	4	-	34
14	" " " " "	105	22	-	-	5	-	27
15	8 Mi. N. Roswell	115	24	6	-	-	-	30
16	" " " " "	75	8	3	3	-	-	14
17	Salt Lakes	90	14	-	-	3	-	17
18	W. Bitter Lake	?	16	-	4	-	-	20
19	3 Mi. S.E. Roswell	112	15	-	3	-	-	18
20	" " " " "	122	25	8	-	-	-	33
21	3 Mi. S. Dexter	106	20	4	2	-	-	26
22	" " " " "	115	18	1	4	-	1	24
23	Salt Lakes	112	15	-	6	-	-	21
24	3 Mi. E. Artesia	121	19	-	7	-	-	26
25	" " " " "	105	17	-	4	-	-	21
26	" " " " "	127	19	-	10	-	1	30
27	Dexter Hatchery	114	20	5	-	-	1	26
28	Bottomless Lakes	106	18	-	Empty	-	-	18
29	" " " " "	50	7	3	-	-	-	10
30	" " " " "	93	14	-	3	-	1	18
31	W. Bitter Lake	81	20	-	Empty	-	-	20
32	" " " " "	103	13	-	3	-	-	16
33	" " " " "	102	13	3	-	-	-	16
34	Orchard Park	85	23	6	1	-	-	30
35	" " " " "	108	18	-	5	-	-	23
36	" " " " "	104	17	4	-	-	-	21
37	" " " " "	82	15	4	-	-	-	19
38	?	112	10	-	12	-	-	22
39	S. Roswell	90	11	-	Empty	-	-	11
40	Salt Lakes	77	12	-	4	-	-	16
41	3 Mi. W. Roswell	109	14	-	22	-	-	36
42	Salt Lakes	100	19	-	1	5	-	25
43	2 Mi. W. Dexter	102	11	7	-	-	-	18
44	Salt Lakes	93	14	-	-	6	-	20
45	Bitter Lake	82	20	-	4	-	-	24
46	5 Mi. W. Bitter Lake	115	22	-	7	-	1	30
47	4 Mi. N. Dexter	90	25	6	-	-	-	31
48	" " " " "	200	36	14	2	-	-	52
49	" " " " "	100	16	8	-	-	1	25
50	" " " " "	132	15	9	-	-	-	24
51	5 Mi. S.W. Roswell	102	18	-	-	7	-	25
Totals		5211	880	124	140	35	9	1188

area was so reduced (Table 1) that the incentive to hunt was almost removed. Provisions were made to estimate the total hunter pressure and total harvest of cranes, along with other game bird species, from a random postal survey of bird hunters.

An analysis of the data derived from this survey results in an estimate that 1,146 hunters hunted cranes at least once during the season. The limits of confidence on this estimate, at the 95-percent level, are from 917 to 1,376.

Field contacts and checking station records show that 160 hunters were checked after bagging at least one crane; 33 of these were hunters who had been checked with cranes previously during the season. This indicated a total of 127 successful individuals checked.

All hunters and grain farmers contacted were generally favorable to the hunting season. However, it seemed to be the almost unanimous opinion of both groups that an October or November open season would be preferable both from the standpoint of hunter interest and relief from local depredations.

(g) Methods of hunting: Since the previous legal hunting of cranes was beyond the memory of most hunters, the most efficient method of harvest was the subject of much discussion. The general opinion, however, was that tactics similar to those used on geese would work on cranes. Check sheets used to record harvest data provided space to indicate the method used by each successful hunter contacted. An analysis of these reports shows that 42 parties totaling 109 hunters took 83 birds by pass shooting, for an average success of .761. This pass shooting was accomplished by the hunter stationing himself near a roosting area in line with the route which he expected the cranes to take as they left the roost.

Those hunters who preferred jump shooting, of whom there were 19 in 11 parties, took 18 cranes for an average success of .947. Jump shooting, in general, consisted of hunters locating themselves around a field in which cranes were feeding and taking their chances on a shot as their companions caused the birds to take flight.

Decoy hunting proved the most successful method when 36 hunters in 16 parties took 40 cranes for an average of 1.111. The cranes decoyed readily to carefully placed decoys in front of well-concealed hunters. Decoys used were painted silhouettes constructed from heavy cardboard, plywood, etc., in conformance with plans furnished hunters by the New Mexico Department of Game and Fish.

(h) Guns and loads: The 12-gauge shotgun was by far the most popular weapon in use, and the popularity of shot sizes was almost equally divided between number 2 and number 4, with the latter showing a slight

margin. Following are the weapons and shot sizes used in taking of the cranes checked:

<u>Shot Gun Size</u>	<u>Number Birds Taken</u>	:	<u>Shot Size</u>	<u>Number Birds Taken</u>
12-gauge	106	:	#4	60
12-gauge 3" mag.	14	:	2	55
16-gauge	14	:	BB	18
20-gauge	5	:	00 buck	9
Not stated	4	:	6	9
		:	4 buck	1
	<u>143</u>	:		<u>152</u> *

*In some cases more than one shot size was noted for one bird.

(i) Distribution of harvest by time of day and day of season: The early morning hours of the day were by far the most productive for the hunter. Of all birds checked, 81 percent were taken before 10:30 a.m. The distribution of the harvest is listed below. It seems evident that an opening hour of 8:00 a.m. could be expected to reduce the kill significantly if that were ever desirable.

<u>Time of Kill</u>	<u>Number Birds</u>	<u>Time of Kill</u>	<u>Number Birds</u>
6:30 a.m. to 8:30 a.m.	71	12:45 p.m. to 3:00 p.m.	9
8:31 a.m. to 10:30 a.m.	45	3:01 p.m. to 5:00 p.m.	9
10:31 a.m. to 12:45 p.m.	8	Not stated	1

Usually by 10:30 a.m. the birds had finished feeding and could be seen circling in great flocks so high that, when viewed from the ground, they were almost indistinguishable.

The harvest was largely accomplished during the first week of the season. After that time, as is shown in Table 1, the cranes had moved from New Mexico into Texas. Had the open season included west Texas, a more complete evaluation of the effects of hunting on the cranes could have been made. A breakdown of the harvest of birds checked is shown

below. It should be noted that no cranes were checked subsequent to January 21.

<u>Day of Season</u>	<u>Number Birds Checked</u>	<u>Day of Season</u>	<u>Number Birds Checked</u>	<u>Day of Season</u>	<u>Number Birds Checked</u>
1	46	8	3	15	1
2	28	9	0	16	1
3	11	10	0	17	4
4	6	11	3	18	0
5	13	12	0	19	0
6	7	13	4	20	0
7	9	14	6	21	1

(j) Distribution of harvest by counties: The harvest geographically was centered in Chaves County, where checking station data and field checks indicate 71.3 percent of the harvest occurred. The harvest in Chaves County from the postal survey accounted for 68.1 percent of the total. In Eddy County, where only 11.9 percent of the cranes checked were taken, the postal survey indicates 20.3 percent of the total harvest. This may be explained by the fact that hunting in Eddy County was accomplished largely by hunters from Carlsbad and Artesia, and consequently a trip to any of the checking stations would have been of considerable inconvenience. In establishing these stations it had been anticipated that very little of the harvest would occur south of Dexter and that Artesia and Carlsbad hunters would be accommodated by the checking station at Dexter. In Roosevelt County, where approximately half of the cranes in the State were feeding and roosting at the beginning of the season, 11.6 percent of the indicated total harvest occurred. Field checks here accounted for 16.8 percent of the cranes checked. This difference may be explained by the open prairie nature of the country, where one can see great distances and should be able to contact a higher percentage of the hunters than would be possible in the brushy Pecos Valley of Chaves and Eddy Counties.

The residential origin of the hunters who contributed to the harvest was largely local (71 percent). Only four nonresident hunters were checked with cranes bagged.

(k) Total harvest: The total harvest of cranes during the season, projected from postal survey data, was 542. This is 1.7 percent of the cranes determined to be present in the area open to hunting at the beginning of the season.

This estimate from a 12.5 percent sample of crane hunters is, at the 95-percent level of confidence, between limits of 427 and 658.

Response bias error was removed from these data through the use of techniques developed by Atwood (1959).

(l) Crippling loss: During the hunting season periodic aerial and ground checks were made on the crane roosting sites and feeding situations for the purpose of detecting crippled cranes. Only three birds fitting this category were found - one on the Lewiston Lake roost, one on Bitter Lake Refuge roost, and one in a field.

Each hunter checked was asked if cranes were hit but not retrieved, and there were 31 affirmative answers to this question. It is not believed, however, that all of these "hits" resulted in fatally injured birds, as observations made in the field indicated that shots which only "dusted" the feathers of a crane were reported as "hit, but not retrieved."

(m) Sporting and table qualities: All hunters contacted expressed their respect for the crane as a game bird. Its extremely cautious and suspicious nature placed the advantage on the side of the bird. The sporting quality was especially touted by those hunters using decoys, who rated the sport equal to, or better than, goose hunting.

The crane prepared for the dinner table was also highly praised. Many methods of cooking were used, ranging from roasting to charcoal broiling. The breast meat, which is dark, was compared to that of the duck or goose, but much drier. The meat of the wings and legs was compared to turkey.

(n) Crane response to hunting: As indicated previously, sandhill cranes are extremely wary. They possess keen eyesight and are quick to detect any objects and movements they are not accustomed to seeing during the course of their daily activities and to avoid them.

All evidence points to the fact that harassment, resulting from the light hunting pressure, triggered the hasty movement of cranes out of New Mexico after the first week of the season. This indicates that sandhill cranes are extremely sensitive to disturbance on their feeding grounds and while moving to and from their roosting areas.

Discussion

The cooperative study of the sandhill crane hunting season, described in this report, provided data which indicate that future controlled hunting seasons in the eastern New Mexico and west Texas area would not be detrimental to either the greater or lesser sandhill crane populations.

About 540 cranes were shot by hunters during the open season, or 1.7 percent of the 31,000 birds present in the hunting area. Further, results of the study indicate that the lesser sandhill crane, because of its extreme wariness and low vulnerability to the gun and because of its excellent table qualities, has the potential of being an important and worthy game species.

Based on contacts with sportsmen and other persons residing in the area of New Mexico opened to crane hunting in 1961, there is good reason to believe that the relatively light hunter response was due to the late opening of the season, lack of knowledge regarding methods of hunting, and the mass exodus of cranes from New Mexico after the first week of hunting. If State law had permitted an open hunting season in the adjacent areas of west Texas, it is quite possible that hunting pressure there would have caused a movement of cranes back into New Mexico. While this is merely supposition and cannot be demonstrated until an open season is held in both States simultaneously, during the period when most crop damage is caused, it is thought that hunting might be a highly successful method of controlling depredations locally. It should be pointed out that the intent of hunting for the control of depredations locally is to disperse populations without reducing them.

The timing of the season must be considered in regard to the depredations problem. In the west Texas and New Mexico region most serious crane depredations usually occur during late October and November when the birds have access to unharvested or shocked sorghum crops. Most of the landowners and sportsmen contacted voiced the opinion that an open hunting season during this period would be optimum both from the standpoint of benefiting the farmers and from obtaining the greatest response from hunters.

An objection to an October or a November sandhill crane hunting season, of course, is that of possible danger to the whooping crane, inasmuch as its migration period sometimes extends into December. This is recognized as a very important consideration. A check of available records, however, shows only one possible whooping crane sighting within the boundaries of the hunting area during the past century. The data at hand, therefore, indicate that an October or November sandhill crane hunting season in west Texas and eastern New Mexico might be held without any danger to the whooping cranes.

The need for more information regarding total numbers, migration dates and routes, and distribution of both the greater and lesser sandhill crane subspecies which winter in the western United States and Mexico is recognized, and it is recommended that studies designed to gain this information be initiated as soon as funds and personnel permit.

Summary

As a result of repeated requests from the Central Flyway States for a lesser sandhill crane hunting season; also to relieve crop losses from crane depredations in Texas and New Mexico as well as the Prairie Provinces of Canada; and because studies indicated that the greater sandhill cranes and the rare whooping crane would not be endangered, the first open season on cranes in over 40 years was held in New Mexico during the period January 1-30, 1961.

When the season opened, a total of 150,000 cranes were counted on the major wintering grounds of west Texas and eastern New Mexico. The 6-county area in New Mexico open to hunting contained 7 roost sites which were utilized by 31,000 cranes. After 1 week of hunting and throughout the remainder of the season this population dropped to approximately 1,500 birds.

It is estimated that 1,146 hunters took advantage of the open season. This relatively light hunting pressure was attributed to unfamiliarity of sportsmen with hunting cranes, the lateness of the season, and to the movement of the crane population out of the hunting area after the first week.

Methods of hunting included jump and pass shooting and shooting over decoys, with the latter proving most successful.

The 12-gauge shotgun with shot sizes of numbers 4 and 2 was the most popular weapon used by the hunters.

A total of 143 cranes, 80 percent in the first 7 days, were checked during the season. Measurements were taken on 137.

The total harvest was estimated to be 542 cranes, or 1.7 percent of the birds in the area open to hunting; and crippling losses were believed negligible.

Sporting and table qualities of sandhill cranes are considered excellent.

From weights and measurements recorded for 137 of the 143 birds checked, it was found that no greater sandhill cranes were included in the bagged sample.

The age and sex ratios were recorded on 137 and 110 cranes, respectively. The ratio for age was 107 adult to 30 immature, and for sex, 59 males to 60 females.

The average weight of 46 adult male cranes was 7 lbs. 12 oz., and of 50 adult females, 7 lbs. 1 oz. When 7 lbs. 4 oz. was used as the dividing line, 82 percent of the adult females checked weighed less and 78 percent of the adult males exceeded this amount.

The most significant difference between male and female measurements existed in the tarsal length, which averaged 186.7 mm. on adult males and 174.9 mm. on adult females.

An analysis of 51 gizzards collected during the season revealed that almost 100 percent of the diet of sandhill cranes during this period is composed of various species of sorghum grains and green alfalfa.

It is concluded that the experimental hunting season was successful, inasmuch as none of the data accumulated indicate that this season or future controlled seasons would have an adverse effect on the sandhill crane species (including the rare subspecies) or on the whooping crane. In order to gain a more objective evaluation of the effects of a hunting season on depredations and flock distribution of the crane populations which winter in the west Texas and eastern New Mexico region, however, it will be necessary to open future seasons in both States simultaneously and at an earlier date.

Additional studies designed to gain information regarding total populations, migration, and distribution of the greater and lesser sandhill crane populations should be initiated as soon as possible.

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APPENDIX

New Mexico Crane Season 1961, Weights and Measurements

Adult Males

No.	Weight		Bill	Wing*	Tail	Tarsus	Midtoe*
	Lb.	Oz.	mm.	mm.	mm.	mm.	mm.
1	7	6	68	459	171	183	68
2	7	3	86	508	171	189	71
3	8	8	87	525	178	216	70
4	8	12	86	489	181	216	76
5	7	0	76	489	165	192	73
6	7	8	76	502	171	176	73
7	6	10	73	511	181	190	76
8	7	15	76	505	203	203	73
9	7	9	70	511	179	165	73
10	7	7	73	470	159	168	64
11	7	0	71	454	176	181	70
12	7	12	78	467	164	179	78
13	8	6	75	510	183	203	73
14	8	4	79	459	181	181	78
15	7	7	71	460	165	171	67
16	8	12	79	527	181	203	76
17	8	1	68	503	178	186	73
18	7	8	79	514	167	159	67
19	8	4	79	511	168	211	79
20	6	2	70	430	164	168	68
21	7	11	71	470	167	183	71
22	7	2	68	495	167	176	62
23	6	3	83	476	159	171	71
24	8	9	82	521	178	203	79
25	8	6	76	521	176	181	79
26	8	0	78	492	178	203	79
27	8	7	73	503	178	191	73
28	7	10	76	483	173	200	73
29	7	12	75	505	186	189	70
30	7	15	75	502	163	187	76
31	7	13	71	489	165	178	70
32	8	3	78	498	179	191	67
33	8	3	73	489	175	198	71
34	8	0	75	502	162	189	70
35	7	4	75	490	168	176	68
36	6	13	76	483	152	184	68
37	8	12	76	519	164	200	78

* These data not used in analysis

1/ Plucked

Adult Males (continued)

No.	Weight		Bill	Wing	Tail	Tarsus	Midtoe
	Lb.	Oz.	mm.	mm.	mm.	mm.	mm.
38	8	7	78	508	165	187	73
39	8	6	70	495	178	187	76
40	7	13	73	470	165	191	87
41	8	4	76	521	178	203	95 <u>2/</u>
42	8	0	76	476	178	184	87 <u>2/</u>
43	8	2	83	527	168	200	71
44	7	14	75	491	184	167	71
45	6	6	78	495	159	184	65
46	7	8	73	514	181	146	73

Adult Females

1	7	1	75	476	167	170	70
2	6	4	70	421	164	159	68
3	7	1	65	454	156	191	78
4	7	10	79	495	178	194	79
5	6	15	70	441	159	178	65
6	6	14	64	476	165	171	68
7	7	3	75	486	165	187	68
8	7	0	<u>3/</u>	450	165	164	70
9	7	0	71	460	173	170	67
10	6	4	64	419	164	164	64
11	7	9	75	470	178	168	68
12	6	8	67	476	149	181	56
13	6	7	68	479	160	157	64
14	6	14	65	465	156	171	65
15	6	6	67	495	165	165	70
16	7	9	<u>4/</u>	473	168	176	70
17	6	15	67	454	159	176	65
18	6	10	71	464	159	167	67
19	7	4	75	483	184	178	76
20	6	14	67	460	165	171	73
21	7	7	67	432	165	178	68
22	7	2	73	454	151	184	64
23	7	12	71	484	164	197	70
24	6	4	83	479	181	156	73
25	6	11	67	484	165	165	73
26	7	15	75	479	159	181	56
27	6	8	78	476	165	203	64
28	6	4	76	465	159	152	79
29	6	13	75	489	156	179	70
30	6	13	71	460	164	189	67

2/ Includes claw3/ Tip of bill broken4/ Head missing

Adult Females (continued)

No.	Weight		Bill mm.	Wing mm.	Tail mm.	Tarsus mm.	Midtoe mm.
	Lb.	Oz.					
31	6	7	71	456	151	173	68
32	6	3	65	433	140	151	59
33	6	9	65	457	164	176	70
34	6	10	68	441	165	179	67
35	6	4	5/ 76	467	179	171	67
36	7	12	76	498	167	186	59
37	6	10	70	443	157	168	64
38	6	15	70	483	154	175	68
39	7	11	68	483	160	187	71
40	6	6	70	467	168	156	67
41	6	7	70	483	165	171	65
42	6	7	76	476	171	194	73
43	7	2	83	483	178	159	67
44	6	9	73	463	159	178	70
45	7	1	70	457	164	178	70
46	6	11	70	483	156	178	67
47	6	8	70	484	159	179	70
48	7	0	76	489	175	191	76
49	7	12	78	489	159	189	70
50	6	0	67	470	175	165	65

Immature Males

1	7	1	73	486	143	189	73
2	6	11	76	486	165	200	78
3	7	0	73	473	149	191	73
4	7	0	67	438	159	162	71
5	6	9	70	470	159	162	67
6	8	5	81	502	151	198	78
7	5	8	65	454	156	171	70
8	7	5	75	473	159	181	70
9	6	3	73	483	130	191	78
10	6	14	70	460	138	164	78
11	7	12	79	502	171	184	73
12	7	14	78	521	159	179	79
13	8	0	70	495	175	210	83

5/ Point of bill missing

Immature Females

No.	Weight		Bill mm.	Wing mm.	Tail mm.	Tarsus mm.	Midtoe mm.
	Lb.	Oz.					
1	6	3	75	495	187	165	66
2	6	4	73	425	159	183	70
3	6	7	71	470	140	175	67
4	5	10	67	448	146	154	57
5	6	8	75	446	167	157	87
6	6	8	73	483	159	178	76
7	7	8	70	476	143	173	70
8	7	4	65	460	146	168	70
9	5	13	70	476	154	178	73
10	7	4	67	473	152	171	64

Adults, Sex Unknown

1	8	8	78	533	171	184	70
2	7	7	83	508	191	191	75
3	7	12	78	489	179	178	73
4	7	5	76	521	191	184	70
5	6	7	64	452	159	165	64
6	7	1	76	486	184	175	57
7	8	1	70	502	184	184	70
8	8	4	83	540	178	184	76
9	8	0	76	483	178	184	84
10	6	7	71	433	168	164	65
11	7	10	70	506	156	179	70

Immatures, Sex Unknown

1	6	0	67	464	152	146	64
2	7	6	73	489	184	184	67
3	6	14	64	468	165	171	83 ^{6/}
4	7	1	70	483	152	178	83 ^{6/}
5	6	8	73	464	152	171	67
6	7	8	70	483	159	165	73
7	6	4	68	443	151	175	64

6/ Includes claw